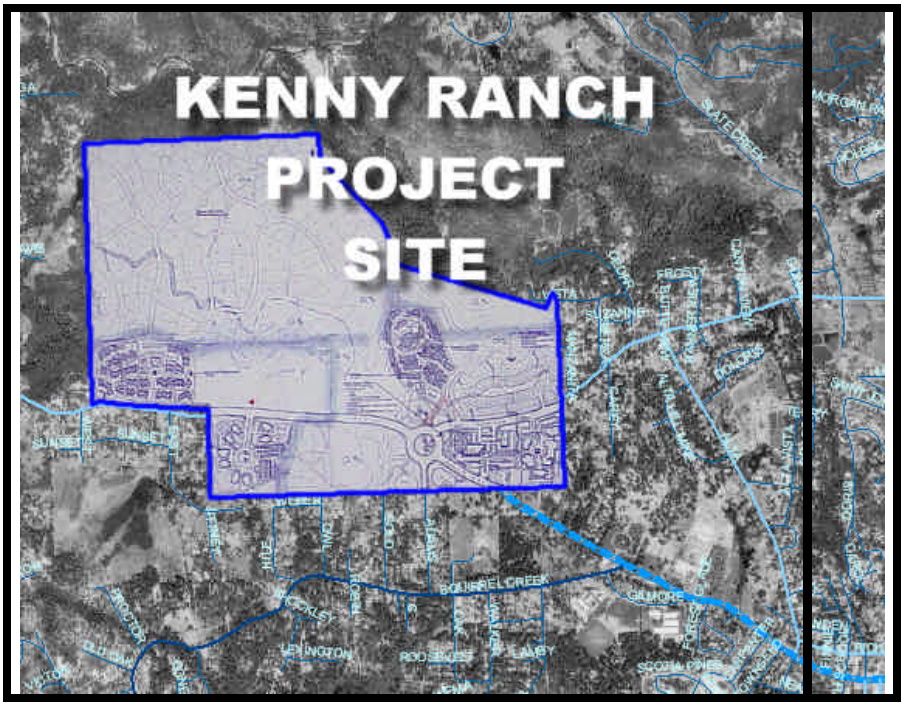
FINAL REPORT



KENNY RANCH
TRAFFIC IMPACT STUDY

Prepared for
THE NEVADA COUNTY TRANSPORTATION COMMISSION

by PRISM Engineering, Grant P. Johnson, PTOE, PE

Professional Traffic Operations Engineer
(P.T.O.E.) in USA
Certificate No. PTOE0063
received May 1999

Professional Engineer in California
Traffic Engineer (T.E.)
Certificate No. TR001453

October 16, 2001

www.prismworld.com, *11140 Fair Oaks Blvd., Ste 3., Fair Oaks, CA 95628 916.967.2000, 916.967-2023 fax*

Executive Summary

The Kenny Ranch Project will bring short term and long term cumulative impacts to the local street system of Grass Valley, in addition to anticipated planned growth, and will cause additional mitigations to be needed in the immediate and long term future to achieve LOS D or better conditions. Several study intersection locations will need mitigation. These mitigations have been organized by the year in which they are needed to come on line.

Opening Year

The Kenny Ranch project is assumed to develop gradually over a 20 year period of time, but will bring construction and new development impacts in the first few years that will require immediate mitigation to maintain LOS D or better conditions on the street system. Many of these improvements have been anticipated in the Traffic Mitigation Fee program, and the Kenny Ranch development should pay its fair share towards these improvements.

The mitigations needed at start of Kenny Ranch project (Year 2001):

- Main Street at Church (coordinated signal with Auburn Street signal). This signal will be part of a coordinated signal system, needed with the addition of Kenny Ranch traffic.
- Main Street at Mill (coordinated signal with Auburn Street signal). This signal will be part of a coordinated signal system, needed with the addition of Kenny Ranch traffic.
- Coordinate the previous two new signals with the existing signal at Main and Auburn Street, so that they run as a coordinated system optimized to keep traffic moving in platoons on Main Street.
- Main Street at Alta will operate at LOS F in WB direction, LOS E in EB direction. Too small and steep for roundabout. A signal is warranted and needed. A short (100') EB left turn pocket with signal installation will mitigate to LOS B (using 60 second cycle length).
- Ridge Road at Rough and Ready Highway will require mitigation with modern roundabout due to operational challenges with access, skewed intersection, site distance problems, and proximity of Adams Avenue. Roundabout will incorporate five intersection approaches: Adams Avenue, Ridge Road, Kenny Ranch north, Main Street, and Rough and Ready Highway. LOS A conditions will result.
- Main Street at Bennett needs a signal to operate at satisfactory levels of service with the development of the project.

- The two closely spaced intersections of Auburn Street at Colfax/Neal and the SR 20 WB onramp need to be combined into a modern roundabout. Traffic conditions go to LOS F at this location with the addition of Kenny Ranch traffic, and the only mitigation is redesign of the entire local intersection system to construct a modern roundabout facility that incorporates the three local intersections: Auburn at Colfax/Neal, at the SR 20 WB onramp and at the Colfax / WB Frontage Road intersection.
- Ridge Road at Alta will operate at LOS F as a 4way stop when Kenny Ranch traffic begins, with delays in the first five years in excess of 1.5 minutes. Removal of the stop controls for Ridge Road approaches and converting this stop control to the side street (Alta) only, will help to keep the heavier traffic volumes on Ridge Road moving. The side street delays would still be in the LOS D range. After five years, it will be time to install a signal.

The coordinated signal system installation on Main Street will also help eliminate the long queue of vehicles along eastbound Main Street which currently backs up through School Street during peak school times, and often as far back as Alta Street. The construction of Kenny Ranch would significantly aggravate this condition, and must be mitigated in the opening year.

Year 2005

At this time period there will be additional impacts from the Kenny Ranch Project, as well as from other cumulative development. The project should pay its fair share towards a mitigation fee program that covers mitigations that include the following capital improvements:

- Ridge Road at Alta will need a traffic signal installed to operate at acceptable conditions.
- Ridge Road at Hughes will have LOS F for the WB through movement, but LOS D for the average intersection LOS. In order to keep the heavier traffic volumes moving on Ridge Road it is recommended that the WB through movement be mitigated. It is possible to install either a signal or a modern roundabout installation at this location, which will yield LOS A. Traffic is fairly equal for all approaches, but a roundabout will provide the least delay for all approaches to this intersection.

Year 2010

No additional mitigations triggered in this year.

Year 2015

No additional mitigations triggered in this year.

Year 2020

After this year, additional mitigations will be needed to the local street system to achieve satisfactory levels of service (LOS D or better).

- A signal will be warranted and needed at the intersection of Morgan Ranch/Sierra College Drive at Ridge Road. LOS A will be the mitigated result from a Year 2020 LOS F condition.
- The intersection of Rough and Ready Highway at Bitney Springs will need to be converted from a 3-way stop sign control to a 1-way stop sign control to give more free-flow movement to the Rough and Ready Highway traffic. Stop signs begin to introduce excessive delays when traffic volumes become large (more than 400 vph on an approach), and either signalization or removal of stop signs is necessary to mitigate traffic flows. It is possible to remove these stop signs and still maintain satisfactory levels of service at the intersection.

Year 2040

Between the Years 2020 and 2040 the Main Street corridor traffic flows will begin to break down as capacity is exceeded, even with the installation of the coordinated signal system. During this time period it will be necessary to convert the local street system to a one-way couplet to increase capacity, reduce traffic conflicts, and enhance the reduction of traffic delays.

Western Bypass Analysis

Several variations of this scenario were programmed into the traffic model, including a “far west” bypass which would cross SR 20 at the Ponderosa over-crossing, but the result was less than 100 vehicles per hour (vph) to the facility, and was ruled out as ineffective in reducing traffic volumes to the downtown Grass Valley area. Traffic on the existing street system will

not travel to it to use it because it is too far out of the way to make it time effective.

Rough and Ready Highway between Bitney Springs and Ridge Road

This section of Rough and Ready Highway will require some widening to provide a median, in order to accommodate the increase in traffic volumes from Kenny Ranch opening day construction through and beyond the Year 2040. A four lane arterial is not required in this section, even at Year 2040. The highest two-way traffic volume total for a two-lane arterial / highway according to Table ES.3 in the NCTC Level of Service Criteria Study[1], is 1,582 vph for LOS D conditions. The Year 2040 volume on R&R Highway in this section without the project was 1,240 vehicles per hour (vph). When the Kenny Ranch project is added in, the overall volume increases to 1,400 vph. This is still within the range allowable for LOS D conditions on a two lane road. The widening of Rough and Ready Highway along the frontage of the Kenny Ranch project will consist of accommodating a painted two-way left turn median along the entire distance. This road widening and restriping should take place at the beginning of construction of the project.

Ridge Road between Rough and Ready Highway and Alta

This segment will need to be mitigated with a two-way left turn lane between the east limits of the project and the intersection with Rough and Ready Highway.

Intersection of Ridge Road and Rough and Ready Highway.

This location is preferably mitigated as a modern roundabout. The existing skewed angle of the intersection does not properly lend itself to conventional signalized installations. In addition to the skewing problem, there will also

[1] **Table ES.3**
Flow Rate Capacities for Nevada County by LOS

LOS	**V/C**	**Ideal Single Lane Flow Rate Capacity on a Two-lane Highway, Category 1**
A	0.60	1,054 vph
B	0.70	1,230 vph
C	0.80	1,406 vph
D	0.90	1,582 vph
E	1.00	1,758 vph

Source: PRISM Engineering and HCM

be an additional access road into the north part of the Kenny Ranch Project, as well as the existing connection to Adams Street. It is not desirable to have more than four intersection approaches to a conventional intersection. For this reason, it is recommended that a modern roundabout be installed at this location as shown on the project site plan. The resulting level of service (LOS) for this location with Year 2040 volumes will be LOS B with a modern roundabout.

Trip Generation Reduction with Proposed Project

The proposed Kenny Ranch project consists primarily of residential development, with some support commercial and industrial uses. When compared to existing zoning, the trip generation is significantly less (less than half). In addition, the commercial uses will help to serve the new local residential development, as well as existing residential uses in the immediate vicinity of the project. This study is based on the developer's estimate of full buildout of the project site by the Year 2020. If Buildout of the project does not occur exactly as estimated in this document (defined in Tables 1A, 1B, 1C, and 1D for trip generation), it is generally appropriate to use the trip generation tables as conditions to trigger needed improvements.

Introduction

The intent of this traffic study is to establish and analyze existing and expected levels of traffic for proposed development of the property known as "Kenny Ranch". This traffic study will be used to determine the impacts of the project on the existing street system for existing, Year 2020, and Year 2040 conditions. This study utilized the recently developed NCTC Viper / TP+ traffic model to forecast traffic volumes, and to develop turning movement and link segment data for the study area.

The study area includes Rough and Ready Highway from Bitney Springs on the west, to Ridge Road at Sierra College Drive on the east, and Kenny Ranch on the north, and SR 20 on the south. Ten study intersections were included in this report, as well as two street segments as defined in the Traffic Analysis section.

Project Description

The proposed project includes the development of the following:

- R1-PD
  191.7 acres
- UHD
  7.6 acres
- OS
  98.8 acres
- BP
  19.1 acres
- C2
  7.8 acres

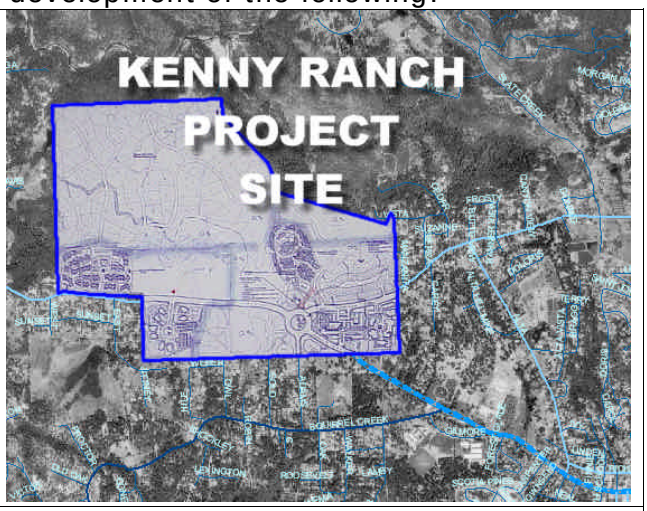


Figure 1 Project Site Map and Land Uses

The Kenny Ranch project will have access to Rough and Ready Highway, and Ridge Road. The specific land uses being proposed are defined in Table 1 which is a summary of the trip generation characteristics of the project, as well as the specific number of dwelling units, the square footages of commercial and industrial buildings, etc. Reference is made to Table 1 for the land use specific details associated with Kenny Ranch.

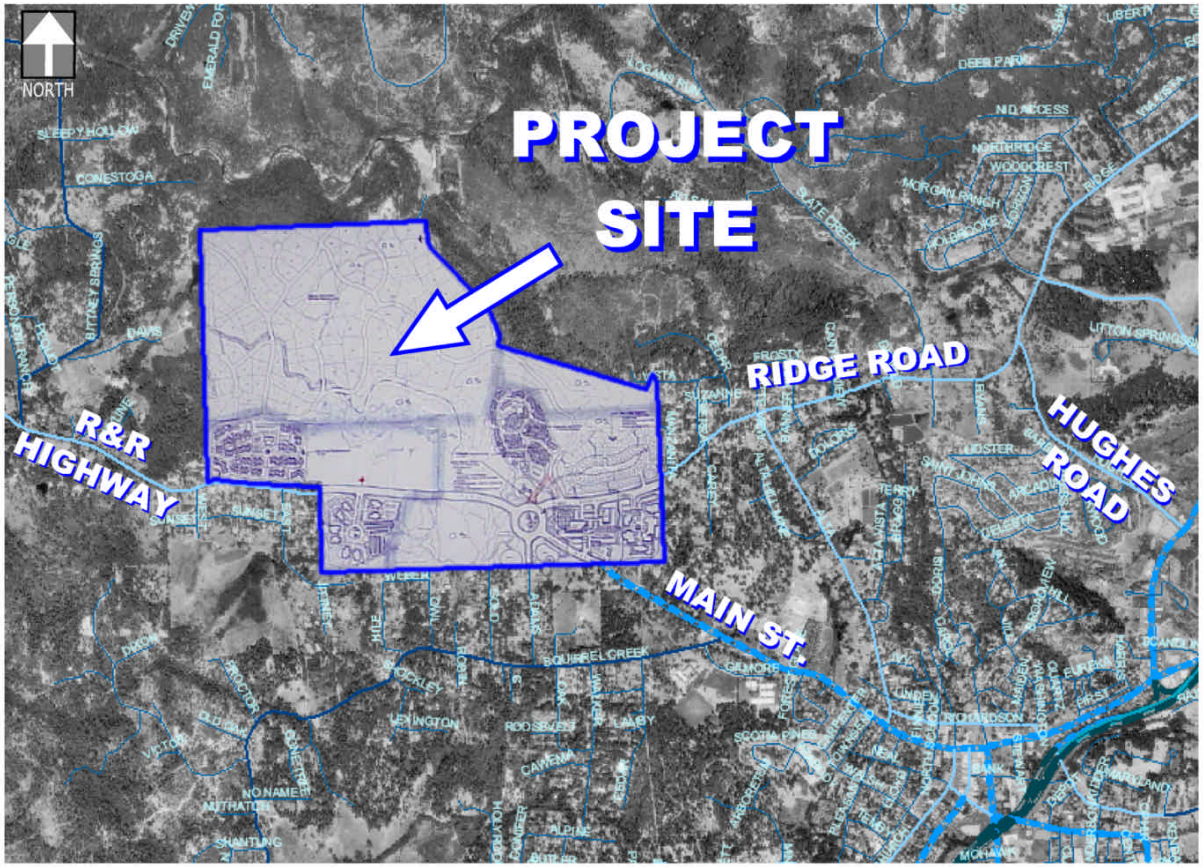


FIGURE 2	KENNY RANCH TRAFFIC STUDY	Project Site and Vicinity
		Prepared by: PRISM ENGINEERING FOR THE NCTC

Project Trip Generation and Distribution

The project was analyzed for four different future time periods including the Year 2005, 2010, 2015, and 2020. Trip generation totals were prepared for each of the years assuming that development would come online gradually, and with an equal amount of growth each five years. The trip generation of the project traffic was calculated using the ITE Trip Generation Manual's data set (6th edition), and with some modifications for Nevada County The trip generation reported for each of the analysis years is given in Tables 1A, 1B, 1C, and 1D for the Year 2005, 2010, 2015, and 2020, respectively. This trip generation was incorporated into the NCTC TP+ traffic model for each of the corresponding analysis years, and assigned to the street network.

Table 1A
Trip Generation for Year 2005

TAZ	ITE Code	Land Use	Quantity	Peak Hour Trip Rate	Peak Hour Trips
101,26	**210**	Single Family Residences (88, 82)	43 DU	0.90	38
22	**850**	Grocery Store / Supermarket	4.8 KSF	11.51	56
64	**820**	Mixed Use Commercial + Apartments	3.7 KSF	4.34	16
23	**812**	A-Z Building Supply	3.8 KSF	4.04	15
21	**845**	Gas Station with Mini Mart and Car Wash	4 pumps	13.38	54
99	**770**	Business Park	30 KSF	1.29	39
99	**151**	Storage Units	8 KSF	0.26	9
28,97	**233**	Condominiums (51, 93)	36 DU	0.55	20
26	**210**	Duplexes	3 DU	0.80	2
24,28,64,99	**220**	Apartments (100+51+15+17)	46 DU	0.62	28
		PM Peak Hour Total >>>		0.25	**277**
Source:	ITE Trip Generation Manual, 6th Edition				
	PRISM Engineering				

Table 1B
Trip Generation for Year 2010

TAZ	ITE Code	Land Use	Quantity	Peak Hour Trip Rate	Peak Hour Trips
101,26	**210**	Single Family Residences (88, 82)	85 DU	0.90	77
22	**850**	Grocery Store / Supermarket	9.7 KSF	11.51	111
64	**820**	Mixed Use Commercial + Apartments	7.4 KSF	4.34	32
23	**812**	A-Z Building Supply	7.5 KSF	4.04	30
21	**845**	Gas Station with Mini Mart and Car Wash	8 pumps	13.38	107
99	**770**	Business Park	60 KSF	1.29	77
99	**151**	Storage Units	16 KSF	0.26	9
28,97	**233**	Condominiums (51, 93)	73 DU	0.55	40
26	**210**	Duplexes	6 DU	0.80	5
24,28,64,99	**220**	Apartments (100+51+15+17)	92 DU	0.62	57
		PM Peak Hour Total >>>			**545**
Source:	ITE Trip Generation Manual, 6th Edition				
	PRISM Engineering				

The project's trip generation is expected to have the greatest impact when the highest volumes are expected on adjacent streets: midweek PM Peak hour between 4:00-6:00 PM. The project trip generation during the PM Peak Hour of an average midweek day is the focus of this analysis. The trip generation totals shown in Table 1A for the Year 2005 amount to 277 trips in the pm peak hour that would be expected to go to and from the Kenny Ranch development. These trips would gain access to the existing street system by several roads and driveways (approximately 10 access points). This will help to spread the load smoothly to the adjacent road system.

The trip generation expected for the Year 2010 from the project is 545 trips per hour, as shown in Table 1B.

Table 1C
Trip Generation for Year 2015

TAZ	ITE Code	Land Use	Quantity	Peak Hour Trip Rate	Peak Hour Trips
101,26	**210**	Single Family Residences (88, 82)	128 DU	0.90	115
22	**850**	Grocery Store / Supermarket	14.5 KSF	11.51	167
64	**820**	Mixed Use Commercial + Apartments	11.0 KSF	4.34	48
23	**812**	A-Z Building Supply	11.3 KSF	4.04	45
21	**845**	Gas Station with Mini Mart and Car Wash	12 pumps	13.38	161
99	**770**	Business Park	90 KSF	1.29	116
99	**151**	Storage Units	24 KSF	0.26	9
28,97	**233**	Condominiums (51, 93)	109 DU	0.55	60
26	**210**	Duplexes	9 DU	0.80	7
24,28,64,99	**220**	Apartments (100+51+15+17)	137 DU	0.62	85
		PM Peak Hour Total >>>			**813**
Source:	ITE Trip Generation Manual, 6th Edition				
	PRISM Engineering				

The trip generation estimates for the Year 2015 are given in Table 1C above, and total 813 trips during the pm peak hour. Table 1D which follows gives the total trip generation that can be expected from the project development, and is projected to be 1081 trips when the project land use totals are multiplied against the ITE trip rates.

It is important to note that the projected total trip generation of the Kenny Ranch project of 1,081 trips by the Year 2020 is a fraction of the amount of traffic that could be generated with existing zoning for the property. The proposed project represents less than 50% of the traffic that could take place with existing commercial zoning. We consulted with the City of Grass Valley to determine appropriate land uses to use for the project with this analysis, and to compare the project to existing zoning for the project site.

Table 1D
Trip Generation for Year 2020

TAZ	ITE Code	Land Use	Quantity	Peak Hour Trip Rate	Peak Hour Trips
101,26	**210**	Single Family Residences (88, 82)	170 DU	0.90	153
22	**850**	Grocery Store / Supermarket	19.3 KSF	11.51	223
64	**820**	Mixed Use Commercial + Apartments	14.7 KSF	4.34	64
23	**812**	A-Z Building Supply	15.0 KSF	4.04	61
21	**845**	Gas Station with Mini Mart and Car Wash	16 pumps	13.38	214
99	**770**	Business Park	120 KSF	1.29	155
99	**151**	Storage Units	32 KSF	0.26	9
28,97	**233**	Condominiums (51, 93)	145 DU	0.55	80
26	**210**	Duplexes	12 DU	0.80	10
24,28,64,99	**220**	Apartments (100+51+15+17)	183 DU	0.62	113
		PM Peak Hour Total >>>			**1081**
Source:	ITE Trip Generation Manual, 6th Edition				
	PRISM Engineering				

New Traffic Count Data Collection

PRISM Engineering conducted new traffic counts to supplement existing intersection data. In addition, new traffic count data was collected on Main Street in late August 2001, after school was in session. These existing conditions counts are summarized in Figure 3 for the pm peak hour.

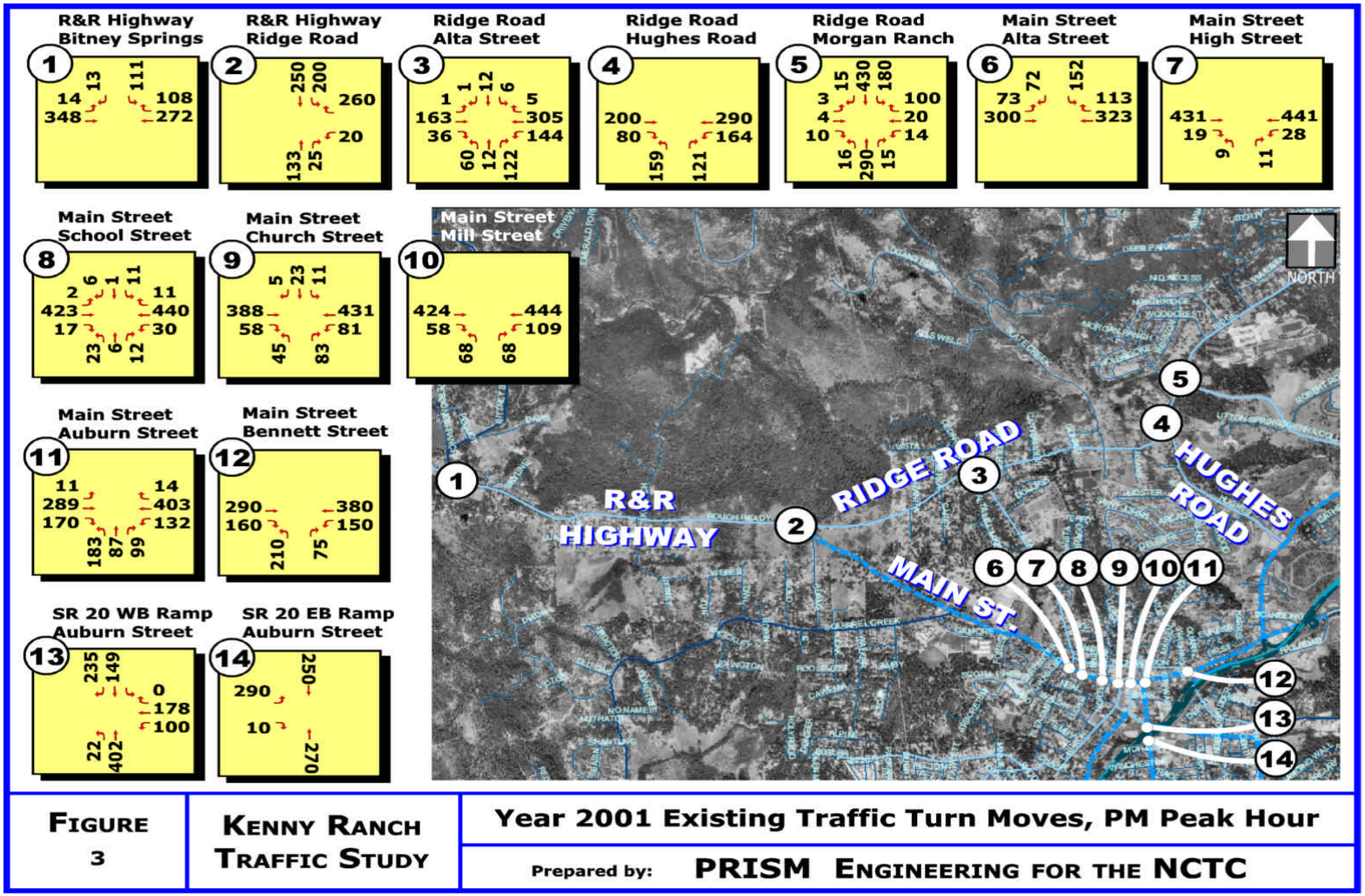


FIGURE 3	KENNY RANCH TRAFFIC STUDY	Year 2001 Existing Traffic Turn Moves, PM Peak Hour
		Prepared by: PRISM ENGINEERING FOR THE NCTC

Traffic Analysis

The traffic analysis was expanded to include several different analysis years, to help determine trigger points for identifying impacts and needed mitigations from the project in five year increments. This analysis study focuses on the existing roadway network in the vicinity of this proposed development, as well as adjacent and key intersections in the vicinity of the project site, including:

1. Rough and Ready Highway at Bitney Springs
2. Ridge Road at Rough and Ready Highway
3. Ridge Road at Alta
4. Ridge Road at Hughes
5. Ridge Road at Morgan Ranch
6. Main Street at Alta
7. Main Street at High
8. Main Street at School
9. Main Street at Church
10. Main Street at Mill
11. Main Street at Auburn
12. Main Street at Bennett
13. Auburn at SR 20 WB ramps
14. Auburn at SR 20 EB ramps
15. Auburn at Colfax / Neal

These intersections and their locations, as well as existing turning movements are identified on Figure 3.

Methodology

Traffic volumes were developed using the NCTC TP+ traffic model for the years 2005, 2010, 2015, and 2020 with and without the project. The goal was to determine the traffic impacts in smaller intervals. Previous studies for this project only looked at the Year 2020 and 2040 with mitigations identified for each. The City of Grass Valley desired to know when the various traffic mitigation improvements would be needed using a time frame in five year increments. The traffic model was set up for each of these analysis years, and the project traffic added to each land use set. The traffic volumes and turning movements for each of the 14 study intersections were tallied in a spreadsheet, and transferred to post-processing traffic analysis and simulation software, namely, Synchro Pro. This software analyzes levels

of service for signalized or unsignalized intersections, and can show simulations of traffic flow in complex intersection systems, such as the one on Main Street between Alta and Auburn.

The NCTC's new and updated traffic model was used to forecast traffic, and Synchro 5.0 was utilized to calculate level of service for each of the study intersections. The Synchro software is now capable of analyzing the intersection turning movements using a variety of different "views" of the traffic impacts, so that a better picture of what is taking place can be seen. In the tables that follow, only the "delay" is reported with a corresponding level of service rating.

Reference is made to Table 2 for a summary of the "delay" level of service criteria used in the analyses. Levels of service were calculated using a delay criteria scale as follows:

Table 2
Delay Level of Service Criteria

LOS	Unsignalized	Signalized
A	1-10 seconds	1-10 seconds
B	11-15 seconds	11-20 seconds
C	16-25 seconds	21-35 seconds
D	26-35 seconds	36-55 seconds
E	36-50 seconds	56-80 seconds
F	51+ seconds	81+ seconds

Source: PRISM Engineering, Synchro Pro, and HCM

The Synchro Pro software interfaces with a companion software product called SimTraffic which simulates traffic flows through specific intersection configurations. It is capable of utilizing vehicle demographics, road grade, width, signal phasing and timing, etc., to accurately diagram traffic flows through one or a series of intersections. We utilized this tool to get a better idea of true traffic performance through closely spaced intersections on the Main Street corridor between Alta and Auburn Street. Traffic delays were visually inspected in addition to examining the reported intersection delay. Several diagrams showing

The traffic simulations for existing conditions show a line of traffic in the eastbound direction of Main Street that extends from Auburn Street back towards School Street for the hourly average. During shorter 15 minute peak periods (such as during school time, etc.) this line of vehicles can extend back to Alta Street, especially during the school peak hour time period. The result of this long line of vehicles is an inefficiency that can only be mitigated in the future with signalization, or with a one-way couplet described later in this report.

For the foreseeable future (next 20 years), a coordinated signal system can be installed at the most critical intersections where backing occurs will mitigate the traffic flow and eliminate the long lines of traffic along Main Street, primarily in the eastbound direction. With coordinated signals on Main Street at Auburn, Mill, and Church Streets, it will be possible to have all three intersections essentially work together increasing efficiency, and moving long lines of traffic quickly, and with a minimum of impact to traffic flow patterns in the area. In the long term future when the coordinated signal system runs its useful course and can no longer move traffic efficiently (post Year 2020), it will be time to implement the One-Way Couplet on the Main Street corridor between Alta and Bennett Street.

Table 3 follows, and reports the unmitigated levels of service for the various analysis years at the 15 study intersections (for the Year 2001, 2005, 2010, 2015, 2020 with and without project scenarios). Table 4 summarizes the results for level of service computations when mitigations are considered. Table 5 reports the specific mitigations for each intersection as needed, and the year in which they are needed to maintain satisfactory levels of service.

Table 3
PM Peak Hour Analysis Summary, Unmitigated

				2001		2001 + Project		2005		2005 + Project		2010		2010 + Project		2015		2015 + Project		2020		2020 + Project	
NODE	Study Intersection			delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS
5491	1	3Way	R & R Highway at Bitney Springs	13	B	13	B	17	C	19	C	21	C	25	C	24	C	31	D	28	D	37	E
5635	2	1Way	Ridge Road at Rough and Ready Highway	9	A	41	E	24	C	56	F	40	E	71	F	55	F	85	F	70	F	100	F
5465	3	4Way	Ridge Road at Alta	30	D	72	F	76	F	134	F	122	F	197	F	168	F	259	F	214	F	321	F
5343	4	3Way	Ridge Road at Hughes	14	B	21	C	26	D	48	E	39	E	75	F	51	E	102	F	63	F	129	F
5251	5	4Way	Ridge Road at Sierra College Drive	12	B	13	B	19	C	29	D	26	D	45	E	33	D	61	F	40	E	77	F
5993	6	3Way	Main Street at Alta	16	C	80	F	33	D	92	F	50	E	105	F	67	F	117	F	84	F	129	F
6009	7	1Way	Main Street at High	1	A	25	C	8	A	30	D	16	B	35	D	23	C	40	E	30	D	45	E
6030	8	2Way	Main Street at School	35	D	45	E	40	E	50	E	45	E	55	F	50	E	60	F	55	F	65	F
6035	9	2Way	Main Street at Church	38	E	50	E	43	E	55	F	48	E	60	F	53	F	65	F	58	F	70	F
6034	10	1Way	Main Street at Mill	40	E	55	F	45	E	60	F	50	E	65	F	55	F	70	F	60	F	75	F
6031	11	Signal	Main Street at Auburn	29	C	26	C	34	C	31	C	39	D	36	D	43	D	41	D	48	D	46	D
6007	12	3Way	Main Street at Bennett	37	E	75	F	87	F	116	F	137	F	157	F	187	F	198	F	237	F	239	F
6176	13	Signal	Auburn at SR 20 WB ramps	14	B	13	B	23	C	23	C	32	C	33	C	41	D	42	D	50	D	52	D
10313	14	1Way	Auburn at SR 20 EB ramps	17	C	43	E	27	D	57	F	37	E	70	F	46	E	84	F	56	F	97	F
6160	15	Signal	Auburn at Neal / Colfax	74	E	85	F	98	F	111	F	121	F	136	F	145	F	162	F	168	F	187	F

Table 4
PM Peak Hour Analysis Summary, with Mitigations

				2001		2001 + Project		2005		2005 + Project		2010		2010 + Project		2015		2015 + Project		2020		2020 + Project		
NODE	Study Intersection			delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	delay secs	delay LOS	
5491	1	1Way	R & R Highway at Bitney Springs																	3	A	4	A	M1
5635	2	Signal	Ridge Road at Rough and Ready Highway	1	A	8	A	6	A	14	B	11	A	19	B	15	B	25	C	20	B	30	C	M2
5465	3	Signal	Ridge Road at Alta	1	A	3	A	6	A	12	B	10	A	21	C	15	B	21	C	19	B	39	D	M3
5343	4	Signal	Ridge Road at Hughes					2	A	2	A	4	A	4	A	6	A	6	A	8	A	8	A	M4
5251	5	Signal	Ridge Road at Sierra College Drive																	7	A	8	A	M5
5993	6	Signal	Main Street at Alta	6	A	11	B	6	A	10	A	6	A	10	A	6	A	9	A	6	A	8	A	M6
6009	7	1Way	Main Street at High	1	A	1	A	1	A	1	A	1	A	2	A	1	A	2	A	1	A	2	A	
6030	8	2Way	Main Street at School	1	A	1	A	1	A	1	A	1	A	2	A	1	A	2	A	1	A	2	A	
6035	9	Signal	Main Street at Church	6	A	3	A	6	A	4	A	6	A	5	A	5	A	5	A	5	A	6	A	M7
6034	10	Signal	Main Street at Mill	9	A	5	A	8	A	5	A	8	A	6	A	7	A	6	A	6	A	6	A	M8
6031	11	Signal	Main Street at Auburn																					
6007	12	Signal	Main Street at Bennett	5	A	6	A	5	A	6	A	6	A	7	A	6	A	7	A	6	A	7	A	M9
6176	13	Round	Auburn at SR 20 WB ramps	16	C	27	D	19	C	28	D	21	C	28	D	24	C	29	D	26	D	29	D	
10313	14	Signal	Auburn at SR 20 EB ramps					2	A	2	A	4	A	5	A	5	A	7	A	7	A	9	A	M10
6160	15	Round	Auburn at Neal / Colfax	16	C	27	D	19	C	28	D	21	C	28	D	24	C	29	D	26	D	29	D	M11

Table 4 reports the revised levels of service for all intersection locations when mitigations are included in the assumptions for analysis. The specific mitigations are listed in Table 5, and correspond to the last column of Table 4 where M1, M2, etc. is indicated on the row where a mitigation is needed. Table 5 also identifies the year in which these mitigations are triggered.

Table 5
Mitigation Summary (for Table 4)

	Location	Mitigation
M1	Ridge Road at Bitney Springs	2Way stop in 2020
M2	Ridge Road at R & R Highway	Roundabout in 2001
M3	Ridge Road at Alta	2way Stop in 2001, signal in 2005
M4	Ridge Road at Hughes	signal or roundabout in 2005
M5	Ridge Road at Sierra College Dr	signal at 2020
M6	Main Street at Alta	signal in 2001, part of system
	Main Street at High	no change
	Main Street at School	no change
M7	Main Street at Church	signal in 2001, part of system
M8	Main Street at Mill	signal in 2001, part of system
	Main Street at Auburn	connect existing signal to system
M9	Main Street at Bennett	signal in 2001
	Auburn at SR 20 WB ramps	Convert to Roundabout in 2001
M10	Auburn at SR 20 EB ramps	signal in 2005
M11	Auburn at Neal / Colfax	Convert to Roundabout in 2001

Road Segment Analysis: Main Street between Alta and Bennett

This street is currently congested and experiences unacceptable conditions during short peak periods in the eastbound direction. Traffic conditions along the Main Street corridor were recently surveyed with detailed turning movement counts in late August 2001. Traffic counts were taken after school was in session in order to capture the worst or highest traffic levels.

Comprehensive 3 hour turning movement counts (3:00 pm to 6:00 pm) were taken on August 28 & 29, 2001 along the Main Street corridor intersections at the following locations:

- Main Street at Alta Street
- Main at High Street

- Main at School Street
- Main at Church Street
- Main at Mill Street
- Main at Auburn Street

These new counts have been summarized and incorporated into Figure 3 of this report. The afternoon and pm time period counted captured both the school traffic in the afternoon, as well as the work commute traffic in the pm peak time period. The traffic counts showed that the afternoon time period which included school traffic was approximately equal in volume to that of the pm peak hour time period on an hourly basis. For this reason, the pm peak hour time period was used in the analysis to be consistent with the analysis time period used for all other study intersections (4:45 pm to 5:45 pm). It was also found that the new traffic counts were very similar to counts previously conducted along the corridor, indicating that there is a consistent volume of traffic that travels the Main Street corridor, and that traffic conditions are fairly predictable.

The congestion along Main Street is primarily in the eastbound direction, and is due to the close proximity of intersections, the number of pedestrians, side street traffic demand, and stop sign control. In particular, the intersections of Auburn Street, Mill Street, and Church Street have been previously identified as closely spaced intersections where demand exceeds capacity during parts of the p.m. peak hour, as well as during the afternoon school peak hour. This street corridor was completely modeled with the Synchro Pro and Sim Traffic software to determine realistic levels of service and traffic operation for the corridor, as a supplement to the individual intersection analyses. Visual inspections of simulations were performed to determine vehicle delays, as well as inspecting individual intersection delays. The results of the analyses showed that with the current volumes and intersection spacings, combined with stop sign control, there will be queues of traffic that extend through each intersection and beyond School towards Alta. The traffic problem is a function of these three inefficient intersections. A coordinated signal system between these three intersections will solve the capacity problem by moving traffic much more efficiently along Main Street. Side street traffic will benefit too by safely gaining access to and from Main Street traffic by virtue of the signal system.

Road Segment Analysis: Rough and Ready Highway between Bitney Springs and Ridge Road

Widening will be needed to accommodate additional traffic volumes through the Year 2040 with the addition of Kenny Ranch project traffic. The primary reason for this is not the magnitude of volume on the street segment, but the increased turning movement activity for traffic entering and leaving R&R Highway as it relates to safety in traffic operations. The Year 2040 volumes were also examined, and still do not require a four lane arterial in this section. A two-lane arterial is sufficient through the Year 2040, but a two-way left turn median is needed to allow left turn movements onto and off of the corridor. Signals will not be needed at any of the driveways to the Kenny Ranch project; a left turn pocket or two-way left turn lane will be sufficient to allow adequate access.

According to the NCTC's recent County-wide study, *Level of Service Criteria Study, May 15, 2001*, the highest two-way traffic volume total for a two-lane arterial / highway for LOS D conditions is 1,582 vph for LOS D conditions (see Table ES.3 in the NCTC *Level of Service Criteria Study*). The Year 2040 volume on R&R Highway in this section without the project was 1,240 vehicles per hour (vph), and increases to 1,400 vph when the Kenny Ranch project traffic is added in. Even with the increase, LOS D would still prevail, as long as adequate access is provided, and to avoid delaying vehicles on R&R Highway and Ridge Road not related to the Kenny Ranch project traffic. For this reason, there will need to be some widening of R&R Highway and Ridge Road in the vicinity of the Kenny Ranch Project to allow for a turning lane in the median. Currently the roads are two lane arterials with no turn lanes in the median.

A two-way left turn lane is recommended for the entire section of R&R Highway and Ridge Road between the western limits of the project site and the eastern limits of the project site, with some breaks in between to accommodate the modern roundabout installation at R&R Highway / Ridge Road.

Intersection of Ridge Road and Rough and Ready Highway.

This location is preferably mitigated as a modern roundabout to better integrate the access of Kenny Ranch with the existing road system. The existing skewed angle of the intersection does not properly lend itself to

conventional signalized installations. In addition to the skewing problem, there is also the close proximity of Adams Street to the intersection, as well as the need to gain additional access via a new road into the north part of the Kenny Ranch Project. It is not desirable to have more than four intersection approaches to a conventional intersection. For this reason, it is recommended that a modern roundabout be installed at this location as anticipated and shown on the project site plan. The resulting level of service (LOS) for this location with Year 2020 volumes will be LOS C with a modern roundabout.

Western Bypass Analysis

A "western bypass" of the City of Grass Valley was entered into the model to determine the effectiveness of reducing traffic impacts from the Kenny Ranch project to the downtown Grass Valley area, etc. It was found that although a significant amount of traffic will use this connection in the future traffic scenarios, it does not significantly reduce traffic to the downtown areas.

Several variations of this scenario were programmed into the traffic model, including a "far west" bypass which would cross SR 20 at the Ponderosa over-crossing. This attracted less than 100 vehicles per hour (vph) to the facility, and was ruled out as ineffective.

When the "far west" bypass was connected to the SR 20 freeway/highway facility, the attraction of vehicles to the facility was still less than 100 vph, indicating that this improvement will not help reduce traffic volumes to the downtown Grass Valley area. It also indicates that the Kenny Ranch traffic is interacting with other local development. Until there is development near or adjacent to the "far west" bypass corridor, traffic on the existing street system will not travel to it to use it because it is too far out of the way to make it time effective.

Realignment of the Main Street / Bennett intersection with Washington

This improvement consists of has been studied previously and in this study as well. and found to have merit for the Main Street corridor. This needed modification was incorporated into the NCTC TP+ traffic model for future scenarios, and Washington Street was realigned in the model to intersect with Bennett Street, creating a 4 legged intersection. This improvement

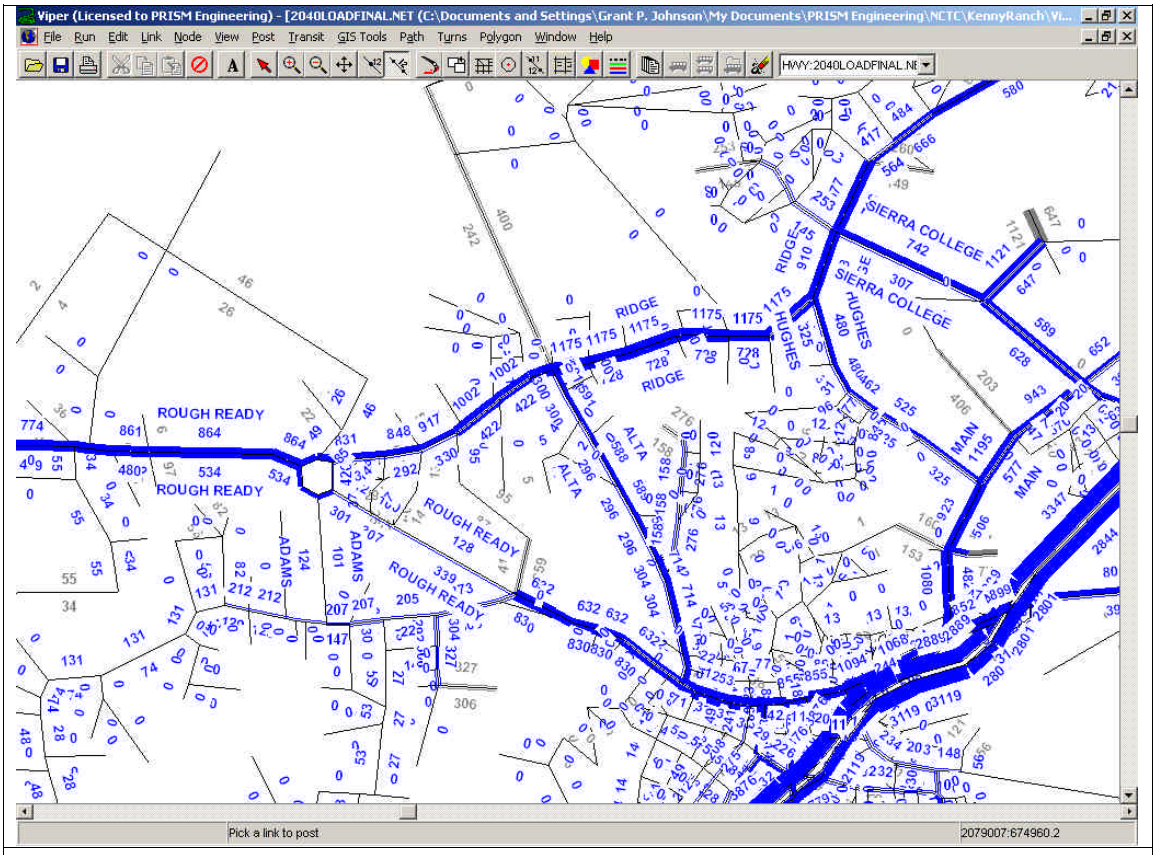
eliminates the existing closely spaced intersections of Washington and Bennett, which creates a traffic operations issue in the vicinity of the post office facility. Combining these two intersections helps increase capacity and moves traffic across Main Street much more efficiently.

One-way Couplet beginning at the Main Street / Bennett intersection with Washington, and ending at Alta and Main.

This potential traffic mitigation was closely examined in the traffic model by converting Main Street (from Alta to Bennett Street) to a one way facility having two eastbound lanes. Richardson would also be converted to a one way facility with two lanes in the westbound direction from Washington to Alta. This change significantly improves the ability of these street to carry traffic, as the majority of cross-street traffic conflicts are eliminated, primarily, opposing left turns. This significantly increases capacity and brings the corridor to LOS A conditions from Alta to Bennett. It is possible that if this change is made to traffic flow along the corridor, that several proposed signals can be eliminated from the improvement plan, including signals at Alta, Church, Mill, and a reduced signal at Auburn Street.

APPENDIX

The following illustration is a sample of the data and Viper / TP+ software that was utilized to determine Year 2001, 2005, 2010, 2015, 2020, and Year 2040 traffic volumes. This software exports the turning movements at nodes or intersections, and that data is further processed in intersection analysis software: Synchro Pro 5.0 and SimTraffic.



Year 2040 With Kenny Ranch Project Traffic Forecasts